

PhD thesis project (Oct. 2019 start)

Sedimentology and (chemo)stratigraphy of Earth's earliest carbonate platform

Host laboratory

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Summary

One of the major consequences of photosynthesis is locally increased carbonate alkalinity, which stimulates the precipitation of carbonate minerals in aqueous environments. On the modern Earth, reef-type ecosystems occupy the most productive end of the oxygen- and carbonate-producing spectrum. However, prior to about 700 million years ago, photosynthetic bacteria fulfilled this role, building reef-like microbialite (e.g., stromatolite) structures, and eventually whole carbonate platforms, out of the carbonate minerals they help precipitate as a consequence of their alkalizing effect. Rather shockingly, the most ancient examples of these systems, dating back to ca. 3.0 Ga, remain little explored. The EARTH BLOOM project examines in detail the stratigraphy, major element and trace element geochemistry of drill core from the 2,940 +/- 2 Ma to 2,925 +/- 3 Ma Ball assemblage, Red Lake Greenstone belt, N. Ontario, Canada. This deposit contains over 400m of metasedimentary rocks that include over 200m of stromatolitic calcite and dolostone carbonates, making it the earliest known significant accumulation of carbonate on the planet. This PhD project will entail a combination of field work and examination of multiple drill cores to establish the depositional history and stratigraphic architecture of this critical deposit. Major, trace, and multiple sulfur isotope data will be acquired using field and drill core samples and used to constrain depositional environments, paleo-redox conditions, and operation of the sulfur cycle at this time. Time permitting, this thesis will also examine the stratigraphy and geochemistry of adjacent carbonate occurrences of similar age that are also being investigated by the project. Candidates should have prior field experience in Precambrian sedimentary settings and proven skills in sedimentology, stratigraphy, and chemostratigraphy. Strong English skills are required. This PhD project is offered in the context of the ERC Starting Grant "EARTH BLOOM".